



SAFETY INVESTIGATIONS

Capt. Nasir Iqbal

Welcome

Introductions

- Name
- Position
- Why are you here

Course Duration

Domestics

MY
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SAFETY INVESTIGATIONS

Capt. Nasir Iqbal



Safety
Management
System

Concept of safety

What is safety?

- Zero accidents or serious incidents (*a view widely held by the travelling public*)
- Freedom from hazards (*i.e. those factors which cause or are likely to cause harm*)
- Attitudes towards unsafe acts and conditions by employees of aviation organizations
- Error avoidance
- Regulatory compliance
- ... ?



Concept of safety (Doc 9859)

Safety is the state in which the risk of harm to persons or property damage is reduced to, and maintained at or below, an **acceptable level** through a **continuing process of hazard identification and risk management**



Regulatory Requirements

- ICAO
 - Annex 19
 - ICAO Doc 9859 (SMM)
- GCAA
 - CAR Part X
 - CAR FAP
 - CAAP 22
 - CAAP 51
 - CAAP 57





SMS - Definition

- A systematic approach to managing safety, including the following:
 - Necessary organizational structures
 - Accountabilities
 - Policies
 - Procedures

The components of SMS

Safety policy and objectives

Safety risk management

Safety assurance

Safety promotion

The elements of SMS



Safety policy and objectives

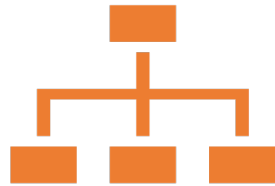
- 1.1 – Management commitment and responsibility
- 1.2 – Safety accountabilities
- 1.3 – Appointment of key safety personnel
- 1.4 – Coordination of emergency response planning
- 1.5 – SMS documentation



Safety risk management

- 2.1 – Hazard identification
- 2.2 – Risk assessment and mitigation

The elements of SMS



Safety assurance

- 3.1 – Safety performance monitoring and measurement
- 3.2 – The management of change
- 3.3 – Continuous improvement of the SMS



Safety promotion

- 4.1 – Training and education
- 4.2 – Safety communication

SMS

SMS takes a holistic approach to safety for all aspects of your organisation and any contracting organisations that you work with



Safety

- ❖ Traditional approach – Preventing accidents
 - Focus on outcomes (causes)
 - Unsafe acts by operational personnel
 - Attach blame/punish for failures to “perform safely”
 - Address identified safety concern exclusively
 - Regulatory compliance

❖ Identifies:

WHAT?

WHO?

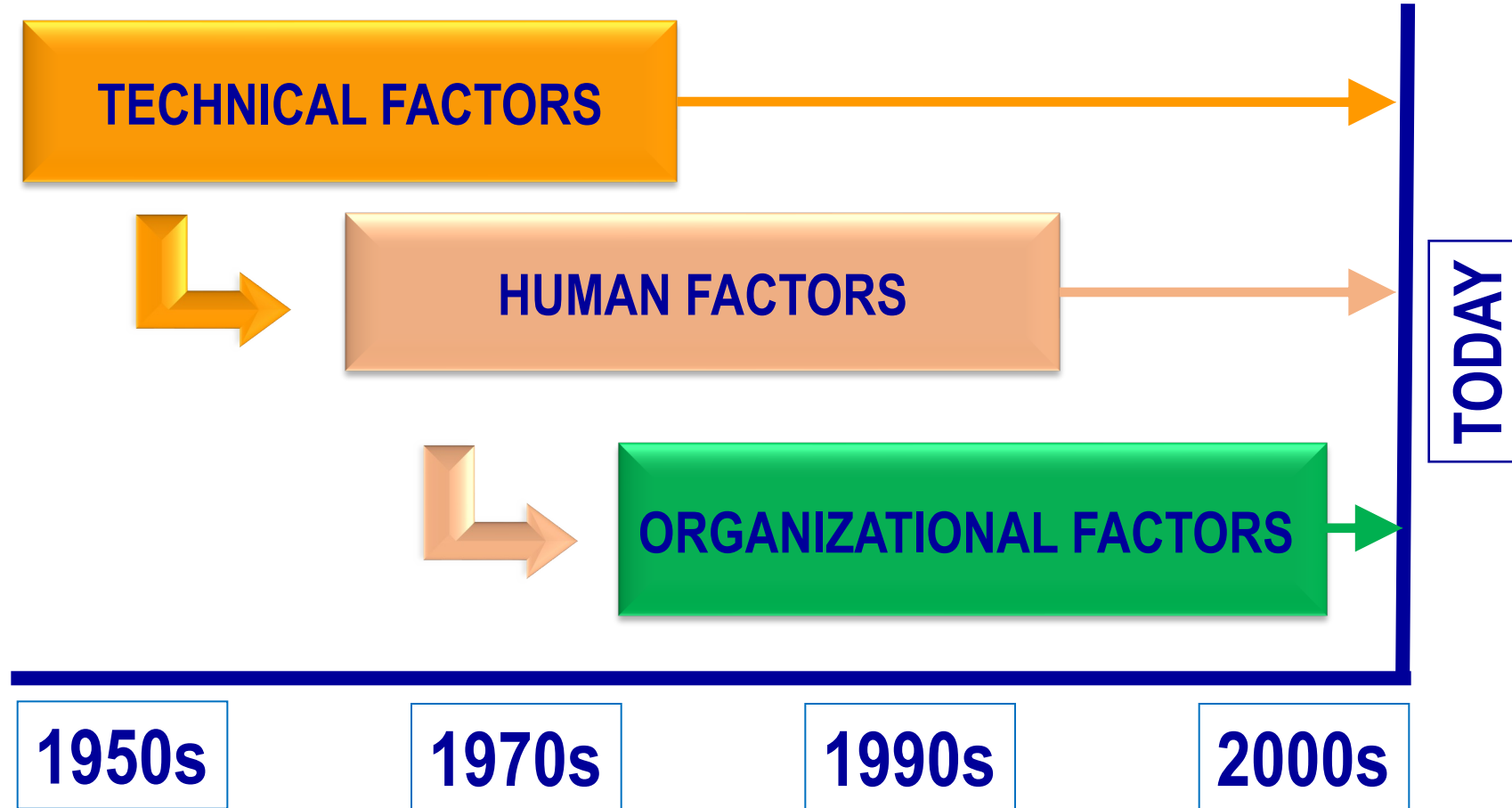
WHEN?

❖ But not always discloses:

WHY?

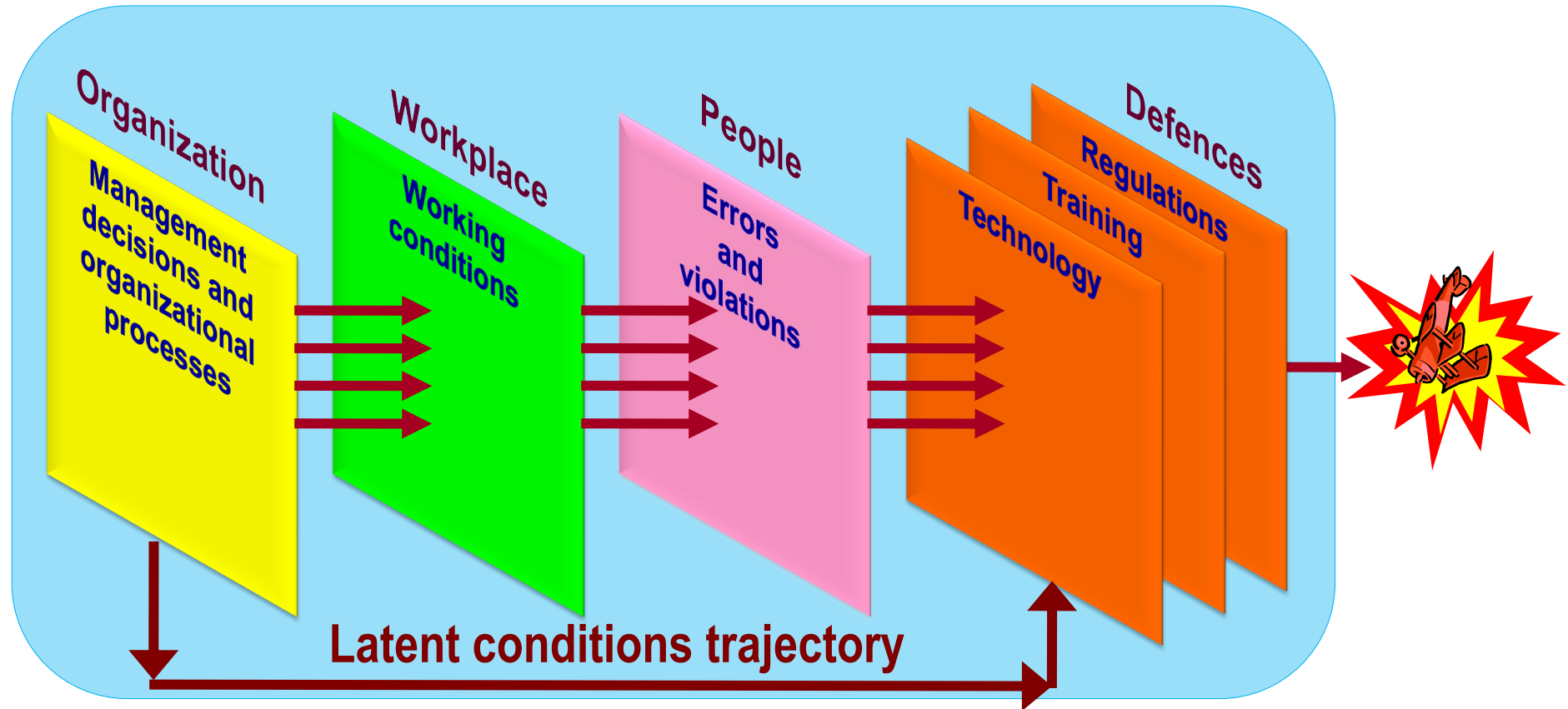
HOW?

The Evolution of Safety Thinking



Source: James Reason

A concept of accident causation



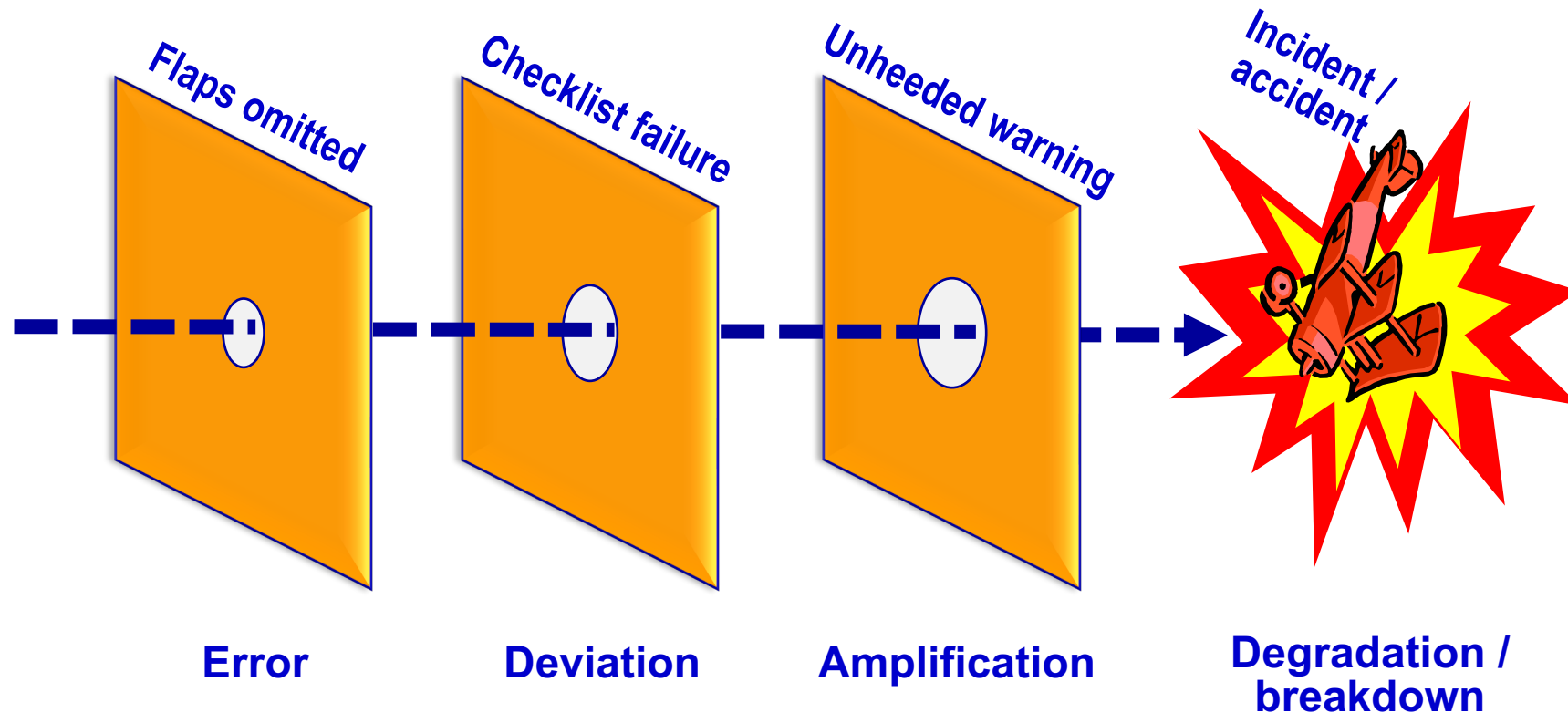
Processes and outcomes



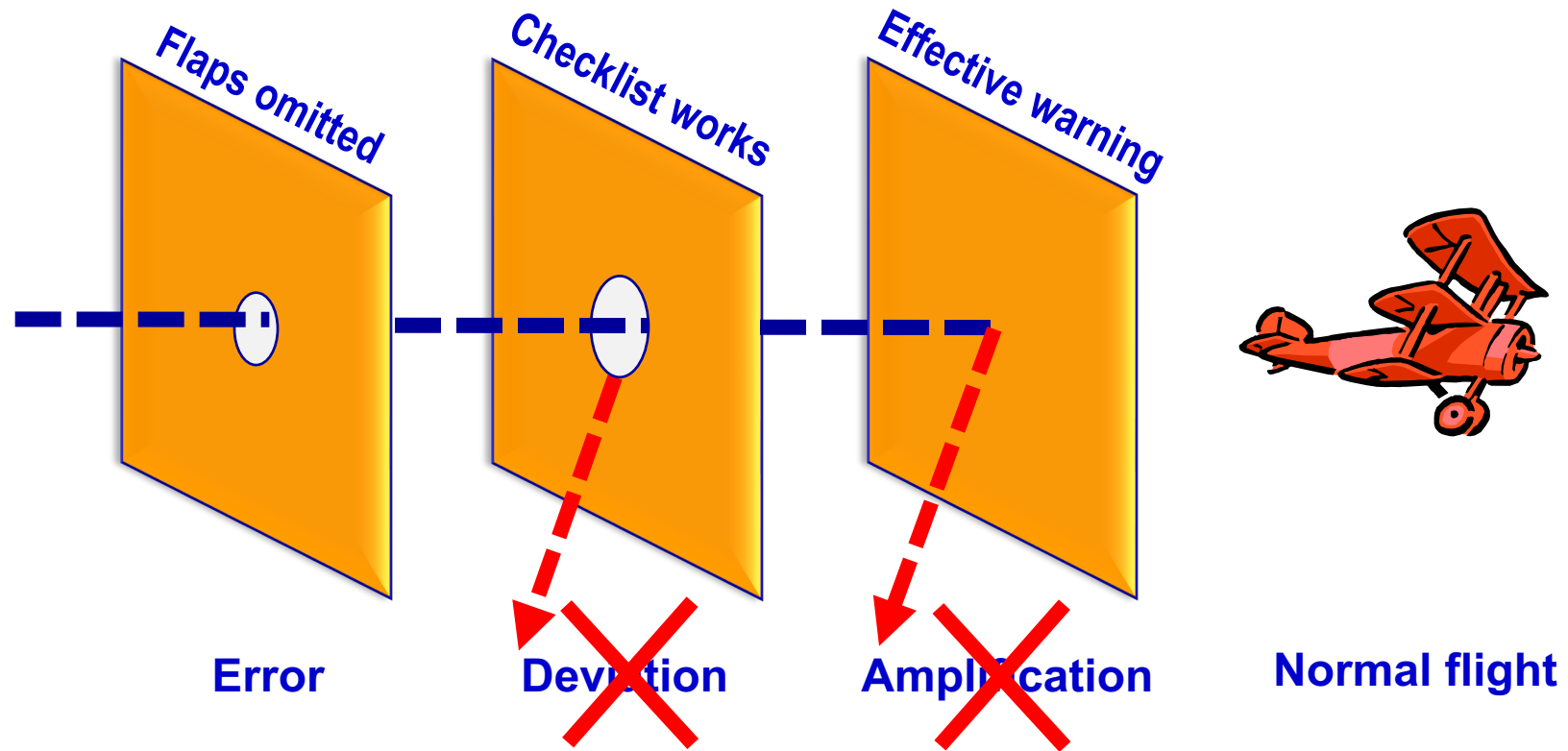
Causes and
consequences
of operational
errors are not
linear in their
magnitude



Accident investigation – Once in a million flights



Safety management – On almost every flight



Human Error

Human error means that something has been done that was "not intended by the actor; not desired by a set of rules or an external observer; or that led the task or system outside its acceptable limits". In short, it is a deviation from intention, expectation or desirability.

Human Factors

The study of **Human Factors** is about understanding **human** behavior and performance. When applied to **aviation** operations, **Human Factors** knowledge is used to optimize the fit between people and the systems in which they work in order to improve safety and performance.

Culture

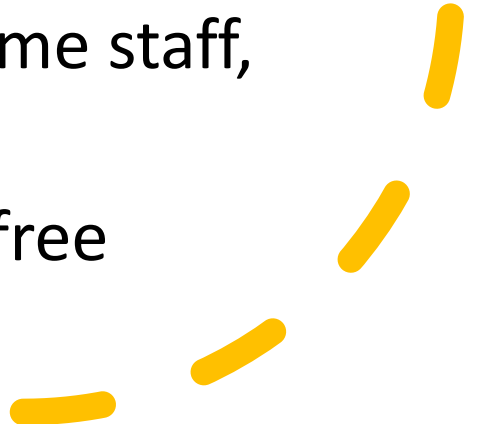
Culture binds people together as members of groups and provides clues as to how to behave in both normal and unusual situations

Culture influences the values, beliefs and behaviours that people share with other members of various social groups

Three cultures



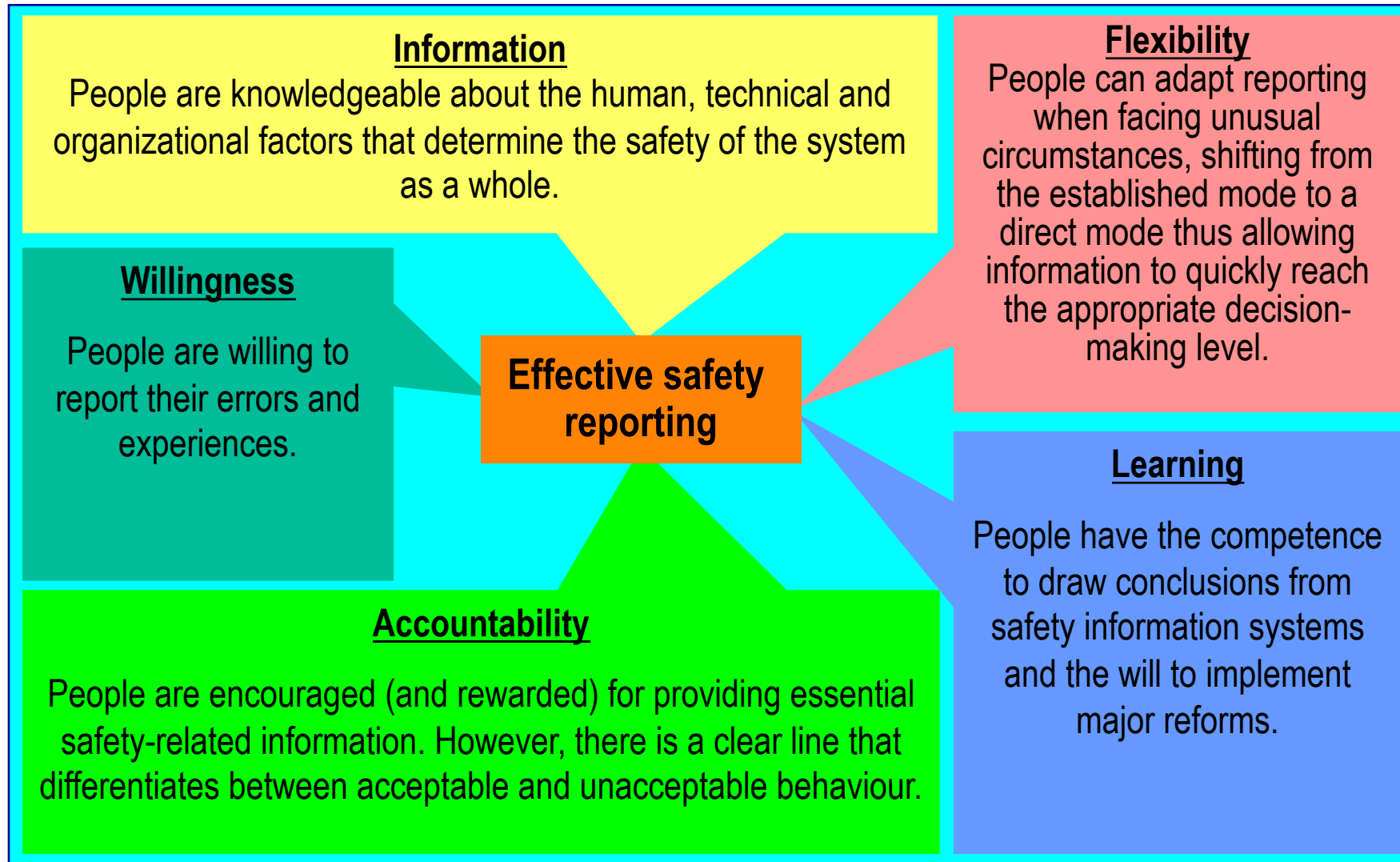
Three distinct cultures

- **National culture** encompasses the value system of particular nations
 - **Organizational/corporate culture** differentiates the values and behaviours of particular organizations (e.g. government vs. private organizations)
 - **Professional culture** differentiates the values and behaviours of particular professional groups (e.g. pilots, air traffic controllers, maintenance engineers, aerodrome staff, etc.)
 - No human endeavour is culture-free
- 

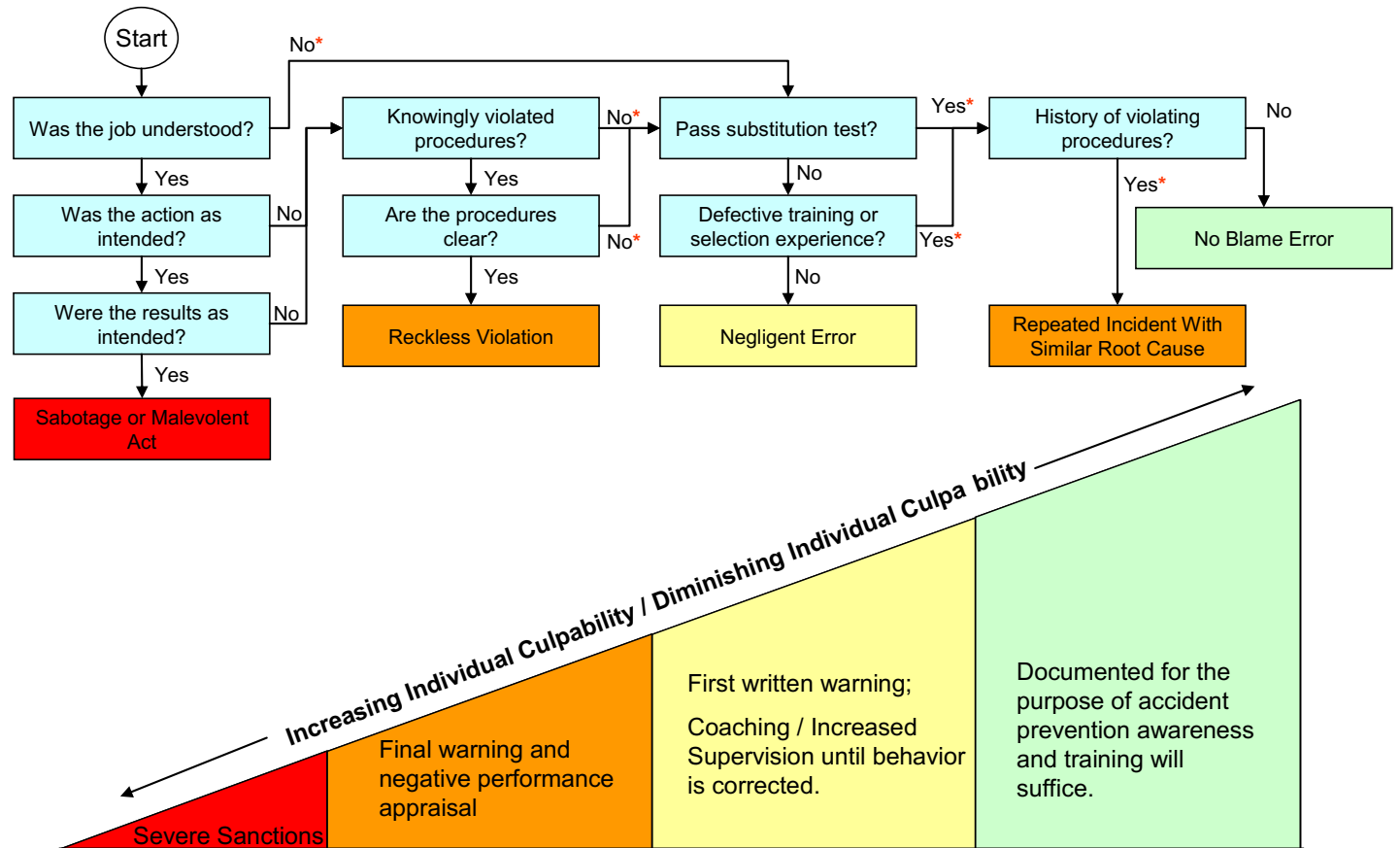
Organizational/corporate culture

- Sets the boundaries for **acceptable behaviour in the workplace** by establishing norms and limits
- Provides a frame work for managerial and employee decision-making
 - ***“This is how we do things here, and how we talk about the way we do things here”***
- Organizational/corporate culture shapes – among many others – **safety reporting procedures and practices by operational personnel**

Effective safety reporting – Five basic traits



Just Culture



* Indicates a 'System' induced error. Manager/supervisor must evaluate what part of the system failed and what corrective and preventative action is required. Corrective and preventative action shall be documented for management review.

What is the fundamental objective of a business organization?



Safety management – Rationale



In order to achieve its production objectives, the management of any aviation organization requires the management of many business processes



Managing safety is one such business process



Safety management is a core business function just as financial management, HR management, etc.

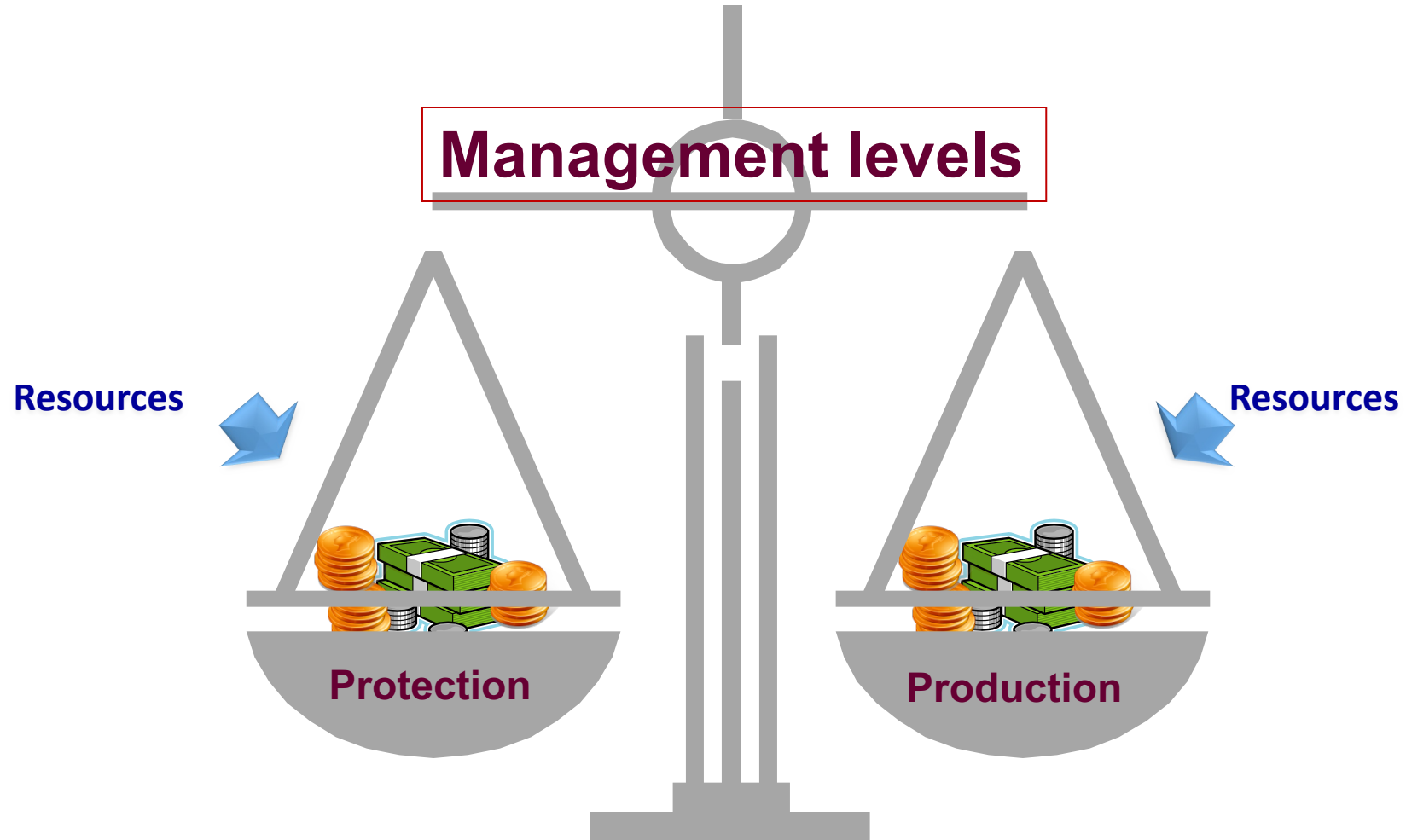


There is no aviation organization that has been created to deliver **only** safety

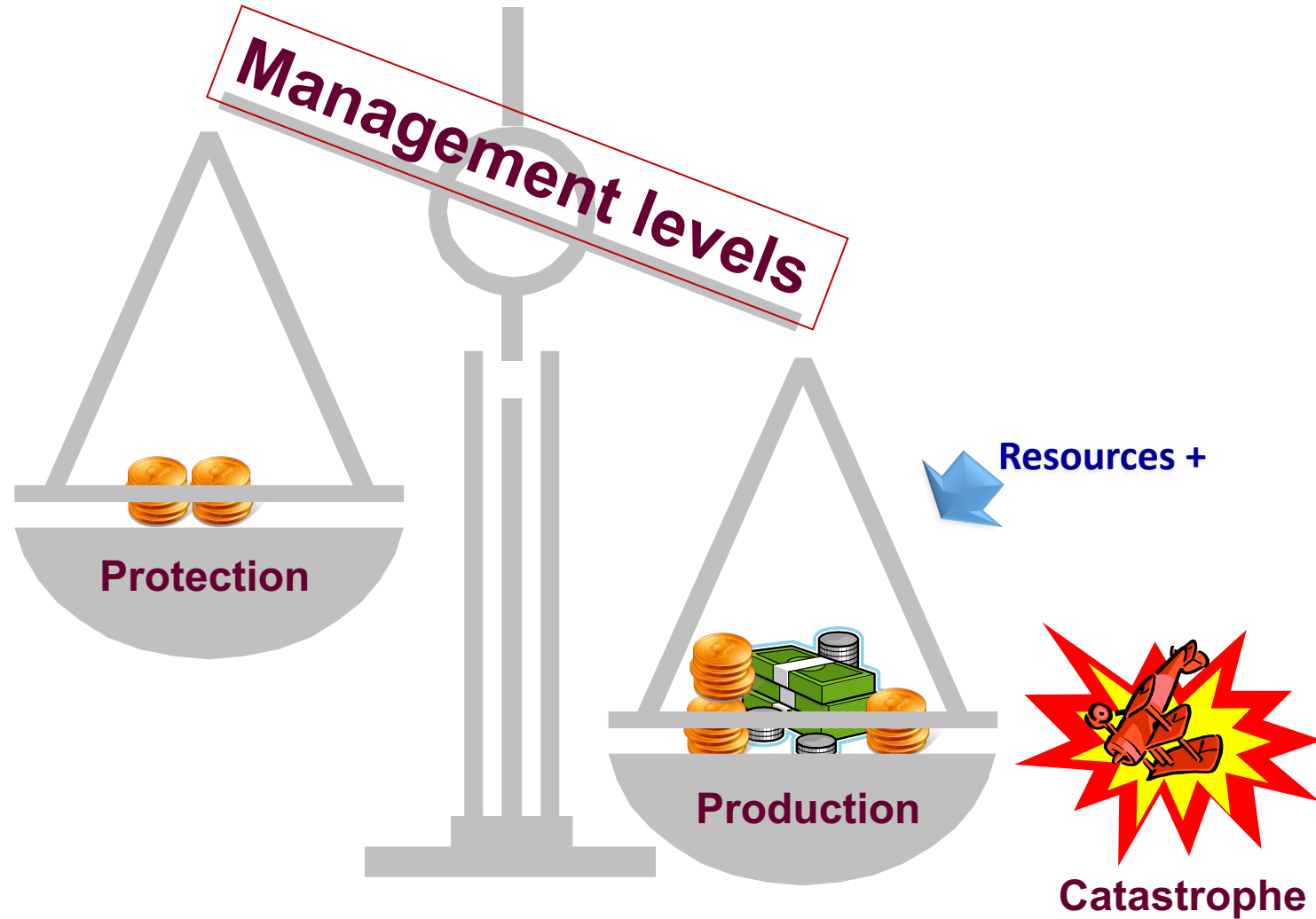


This brings about a **potential** dilemma for management

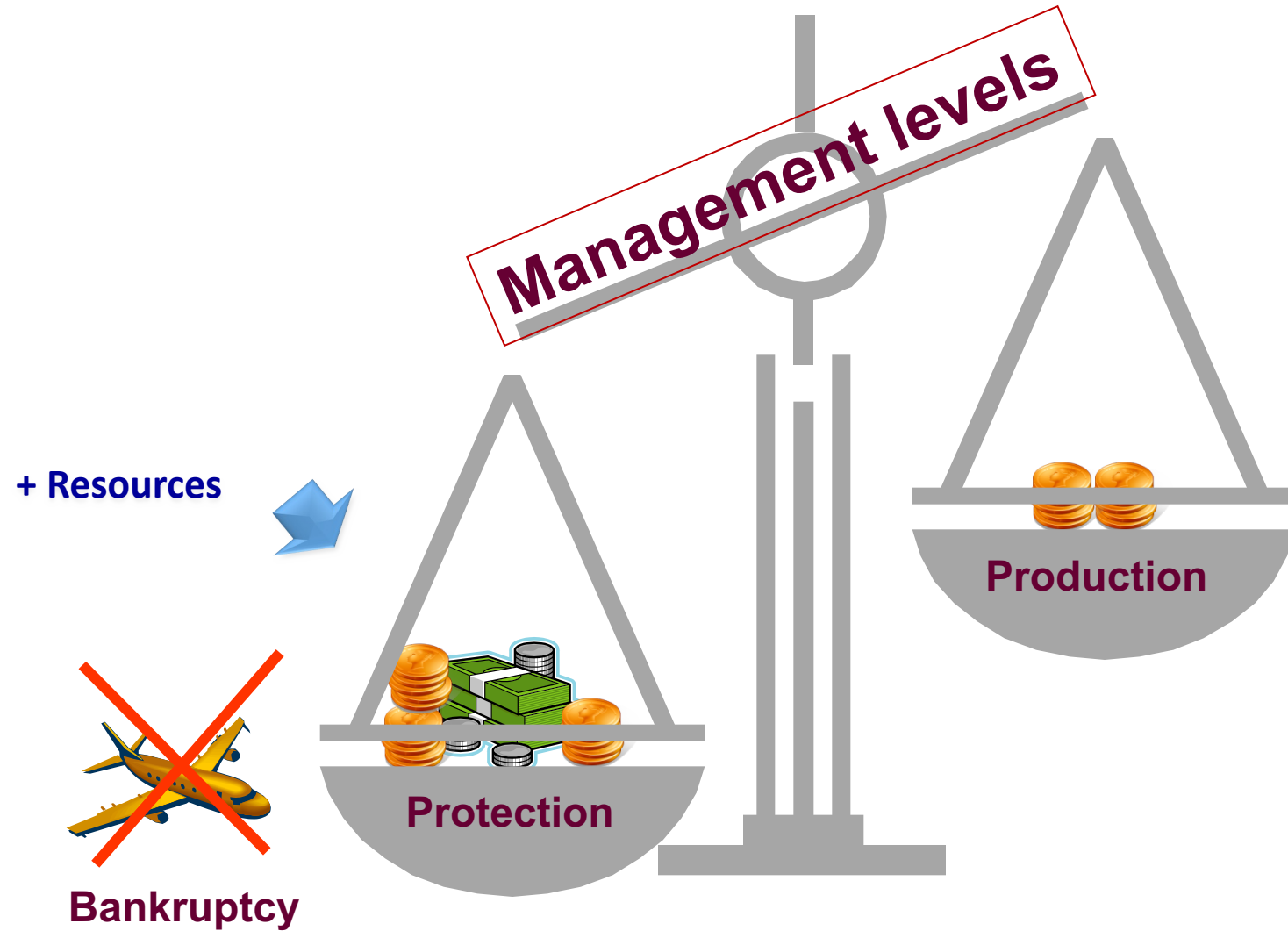
The management dilemma



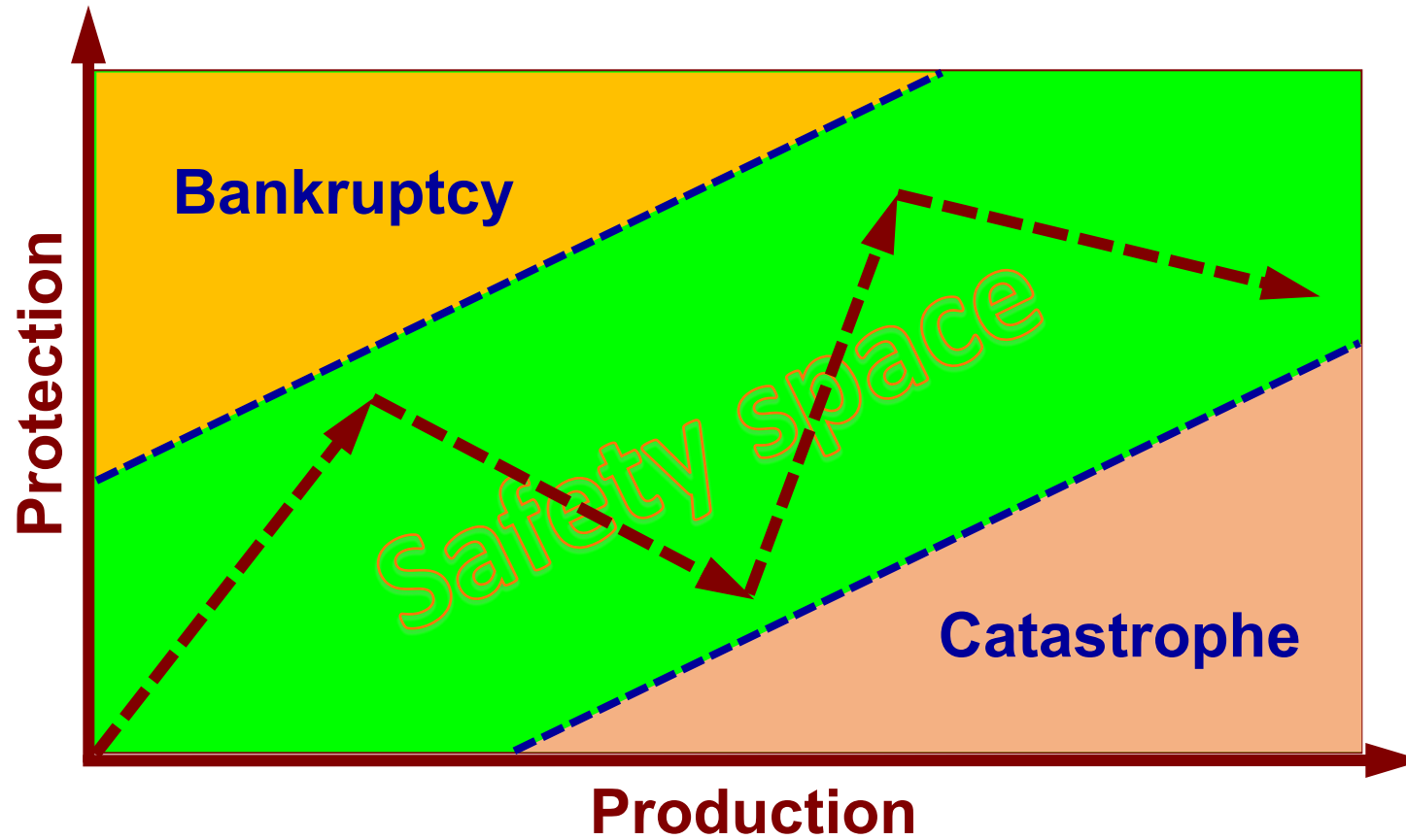
The management dilemma



The management dilemma



Safety space



Safety management – The response to the dilemma



Safety issues are a by-product of activities related to **production/services delivery**



An analysis of an organization's resources and goals allows for a balanced and realistic allocation of resources between **protection and production goals**, which supports the needs of the organization



The product/service provided by any aviation organization must be delivered safely (*i.e. protecting users and stakeholders*)

The essential is invisible to the eyes

Number of occurrences

1 – 5

Accidents

30 – 100

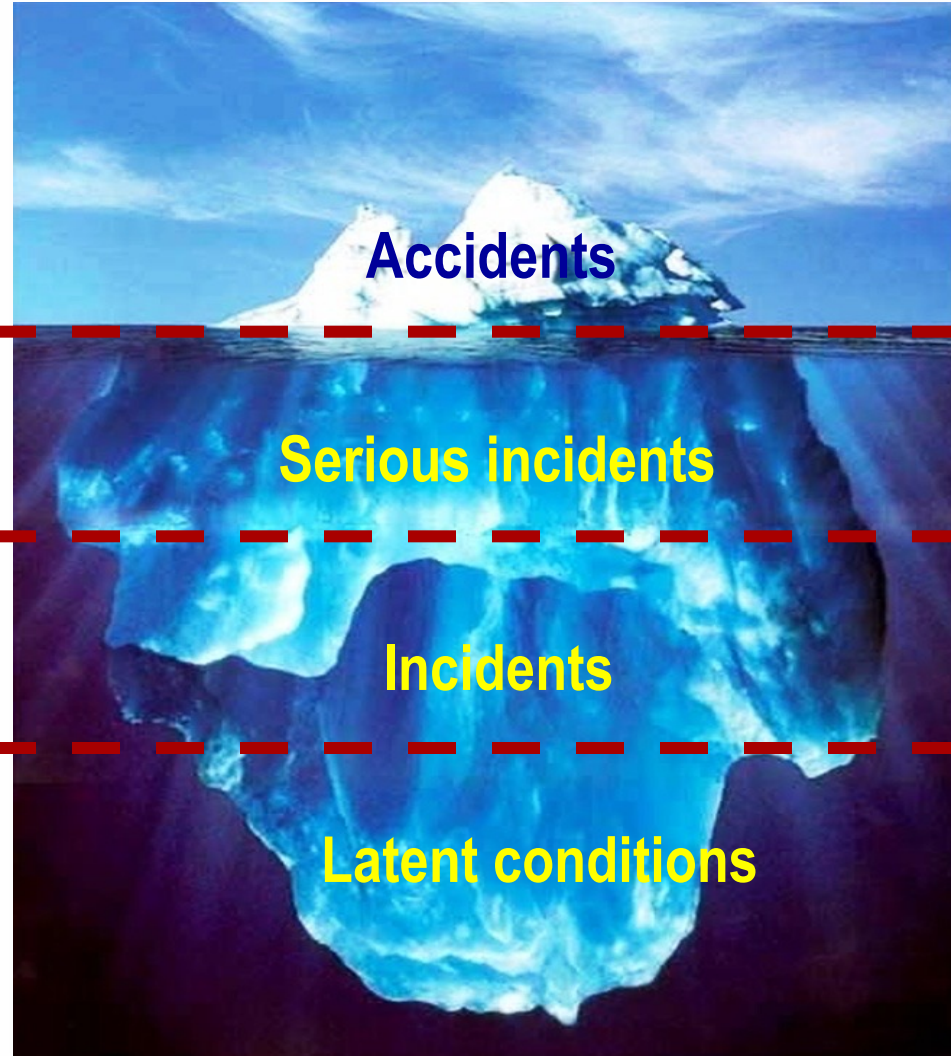
Serious incidents

100 – 1000

Incidents

1000 – 4000

Latent conditions



Reactive safety management

- **Investigation of accidents and serious incidents**
 - Based upon the notion of waiting until something breaks to fix it
 - Most appropriate for:
 - situations involving failures in technology
 - unusual events
 - The contribution of reactive approaches to safety management depends on the extent to which the investigation goes beyond the triggering cause(s), and includes contributory factors and findings as to risks

Proactive safety management

- **Mandatory and voluntary reporting systems, safety audits and survey**
 - Based upon the notion that system failures can be minimized by:
 - identifying safety risks within the system before it fails; and
 - taking the necessary actions to reduce such safety risks

Predictive safety management

- **Confidential reporting systems, flight data analysis, normal operations monitoring.**
 - Based upon the notion that safety management is best accomplished by looking for trouble, not waiting for it
 - Aggressively seek information from a variety of sources which may be indicative of emerging safety risks

Safety management – Eight building blocks



Senior management's **commitment** to the management of safety



Effective safety reporting



Continuous monitoring through systems to **collect, analyse, and share** safety-related data arising from normal operations



Investigation of safety occurrences with the objective of identifying systemic safety deficiencies rather than assigning blame

Safety management – Eight building blocks



Sharing safety lessons learned and best practices through the active exchange of safety information



Integration of safety training for operational personnel



Effective **implementation** of Standard Operating Procedures (SOPs), including the use of checklists and briefings



Continuous improvement of the overall level of safety



Staff Safety Responsibilities

- Safety requirements as per job function
- Identification and reporting of hazards
- Timely actions in response to safety situations



Hazards

Two definitions

- **Hazard** – Condition or object **with the potential** of causing injuries to personnel, damage to equipment or structures, loss of material, or reduction of ability to perform a prescribed function
- **Consequence** – Potential outcome(s) of the hazard
 - *Uncalibrated tool is a **hazard***
 - *Engineer may not be able to assemble the components correctly is one of the **consequences** of the hazard*

First
fundamental –
Understanding
hazards

- **Types of hazards**

- Natural
- Technical
- Economic



Hazard identification

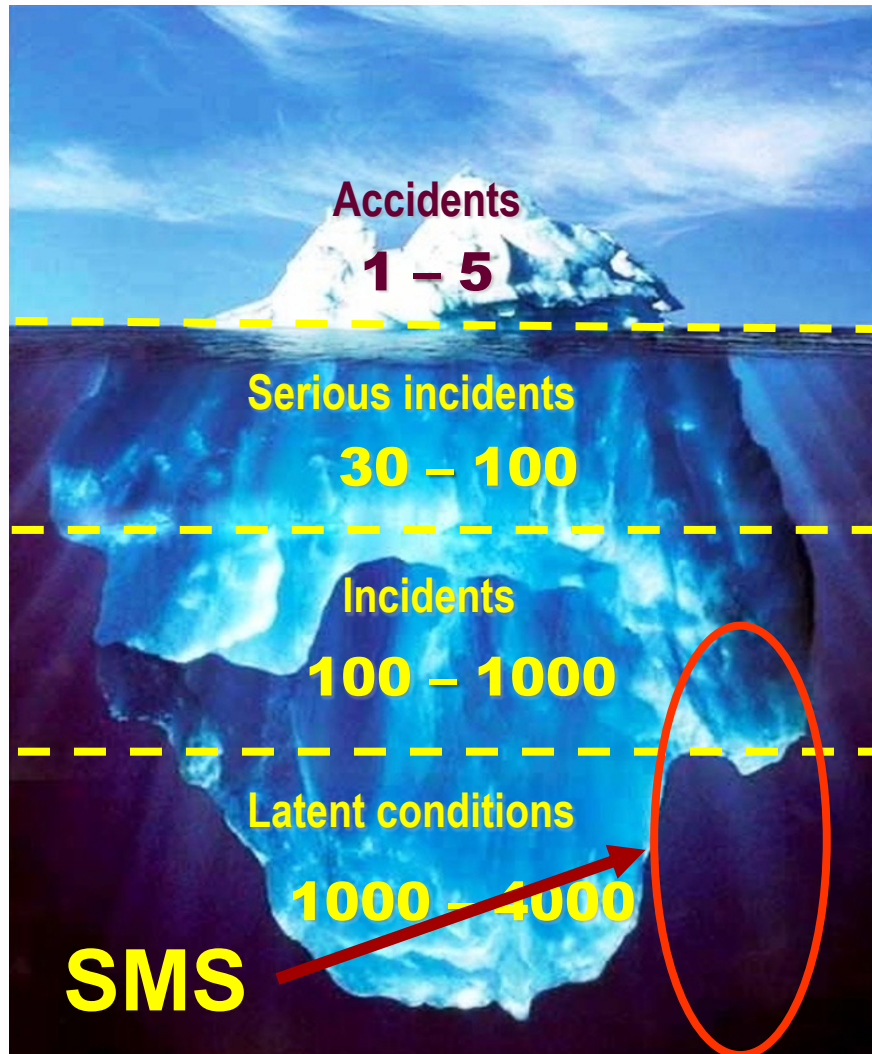
- **By whom?**
 - By anybody AND/OR
 - By designated personnel
- **How?**
 - Through formal processes AND/OR
 - Any available means
- **When?**
 - Anytime AND/OR
 - Under specific conditions



Documentation of hazards

- Appropriate documentation management is important as:
 - It is a formal procedure to translate operational safety data into hazard-related information
 - **It becomes the “safety library” of an organization**

The focus of hazard identification



Hazard identification is a wasted effort if restricted to the aftermath of rare occurrences where there is serious injury, or significant damage.

A close-up, low-angle shot of a helicopter's instrument panel at night. The panel is illuminated, showing various gauges and dials. The background is a blurred view of city lights from the cockpit. An orange horizontal bar is in the top right corner.

Aviation Safety Investigation

A top-down view of various safety and investigation tools laid out on a wooden plank surface. The items include a yellow hard hat, a pair of yellow work gloves, a pair of safety glasses, a high-visibility orange and grey vest, a pair of brown leather work boots, a black and white flashlight, a yellow and black respirator mask, a white measuring tape, and several wooden rulers. The text "Safety Investigation vs Accident Investigation" is overlaid in the center in a white, sans-serif font.

Safety Investigation vs Accident Investigation



WHAT IS THE PURPOSE OF AVIATION SAFETY INVESTIGATION?

PURPOSE OF AVIATION SAFETY
INVESTIGATION IS TO:

AVOID RECURRENCE IN FUTURE

HOW DO YOU AVOID RECURRENCE IN FUTURE



Finding the root causes



Fixing the identified root causes





RESPONSIBILITY



Finding the root causes
INVESTIGATOR

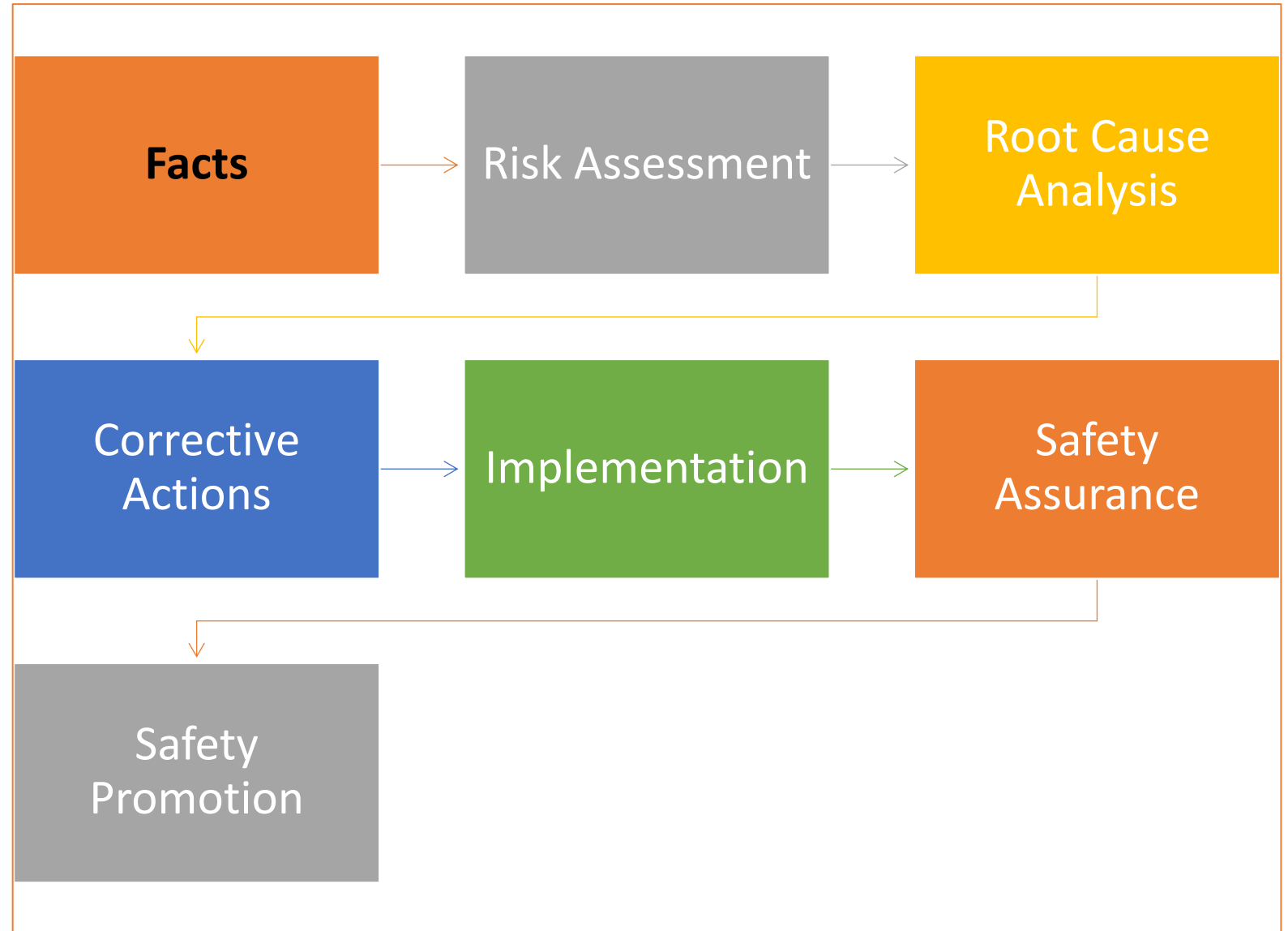


Fixing the identified root causes
MANAGEMENT

Structure of Safety Investigation



Structure of Safety Investigation



Safety Investigation – FACTS

Aircraft Type and Registration:

Date and Time of Incident:

Flight Number:

Location:

Persons on Board:

Crew

Passengers

Injuries:

Crew

Passengers

Nature of Damage:

NCAA Report No:

Safety Investigation – FACTS

Cont'd

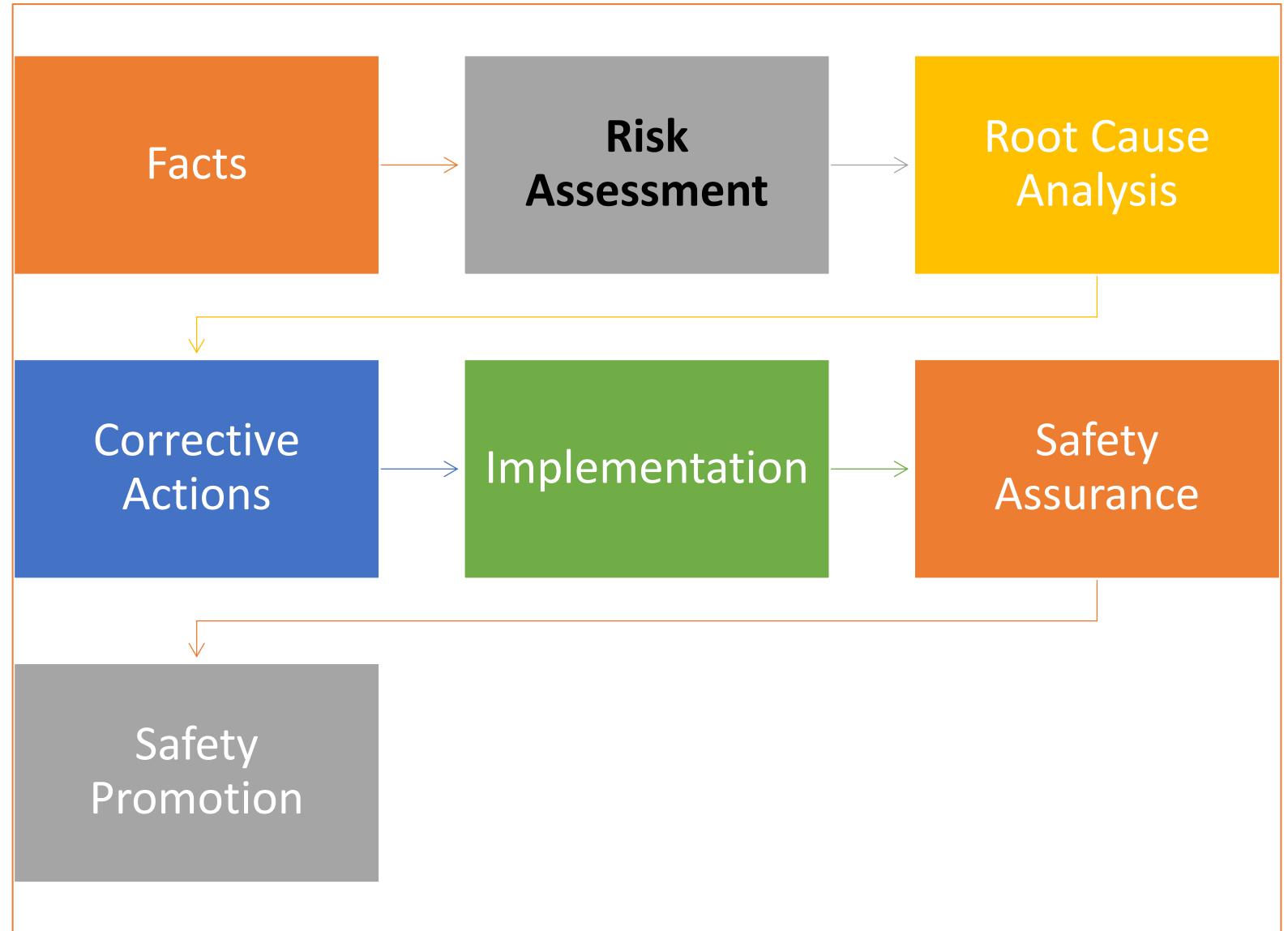
Investigation Case ID	
Lead Investigator	
Document Owner	
Investigation Team	
Publication Date	

Safety Investigation – FACTS

Cont'd

Scope of Investigation			
Responsibilities	Lead	Member 1	Member 2

Structure of Safety Investigation



Safety Investigation – RISK ASSESSMENT

In Puts

- Details of the events
 - Reports
 - Statements
 - Technical Documents

Tools

- Risk Assessment Matrix
- Hazard Register consultation
- Investigation Team discussions

Out Put

- Identified risks
- Risk Index

Risk Matrix

RISK SEVERITY						
RISK PROBABILITY		5 Catastrophic	4 Critical	3 Significant	2 Marginal	1 Negligible
	5 Frequent	25 Unacceptable	20 Unacceptable	15 Unacceptable	10 Mitigable	5 Mitigable
	4 Reasonably Probable	20 Unacceptable	16 Unacceptable	12 Mitigable	8 Mitigable	4 Acceptable
	3 Remote	15 Unacceptable	12 Mitigable	9 Mitigable	6 Mitigable	3 Acceptable
	2 Extremely Remote	10 Mitigable	8 Mitigable	6 Mitigable	4 Acceptable	2 Acceptable
	1 Extremely Improbable	5 Mitigable	4 Acceptable	3 Acceptable	2 Acceptable	1 Acceptable

Risk Matrix

Definitions	Risk Probability				
	1 Extremely Improbable	2 Extremely Remote	3 Remote	4 Reasonably Probable	5 Frequent
Qualitative definition	Almost inconceivable that the event will occur.	Very unlikely to occur or not known to occur	Unlikely to occur but possible or has occurred rarely.	Likely to occur sometimes or has occurred infrequently	Likely to occur many times or has occurred frequently
Quantitative definition	Likely to occur as often as once in any 5 year period.	Likely to occur as often as once in any 3 year period.	Likely to occur as often as once in any 1 year period.	Likely to occur as often as once in any 3 month period	Likely to occur as often as once in any 1 month period.

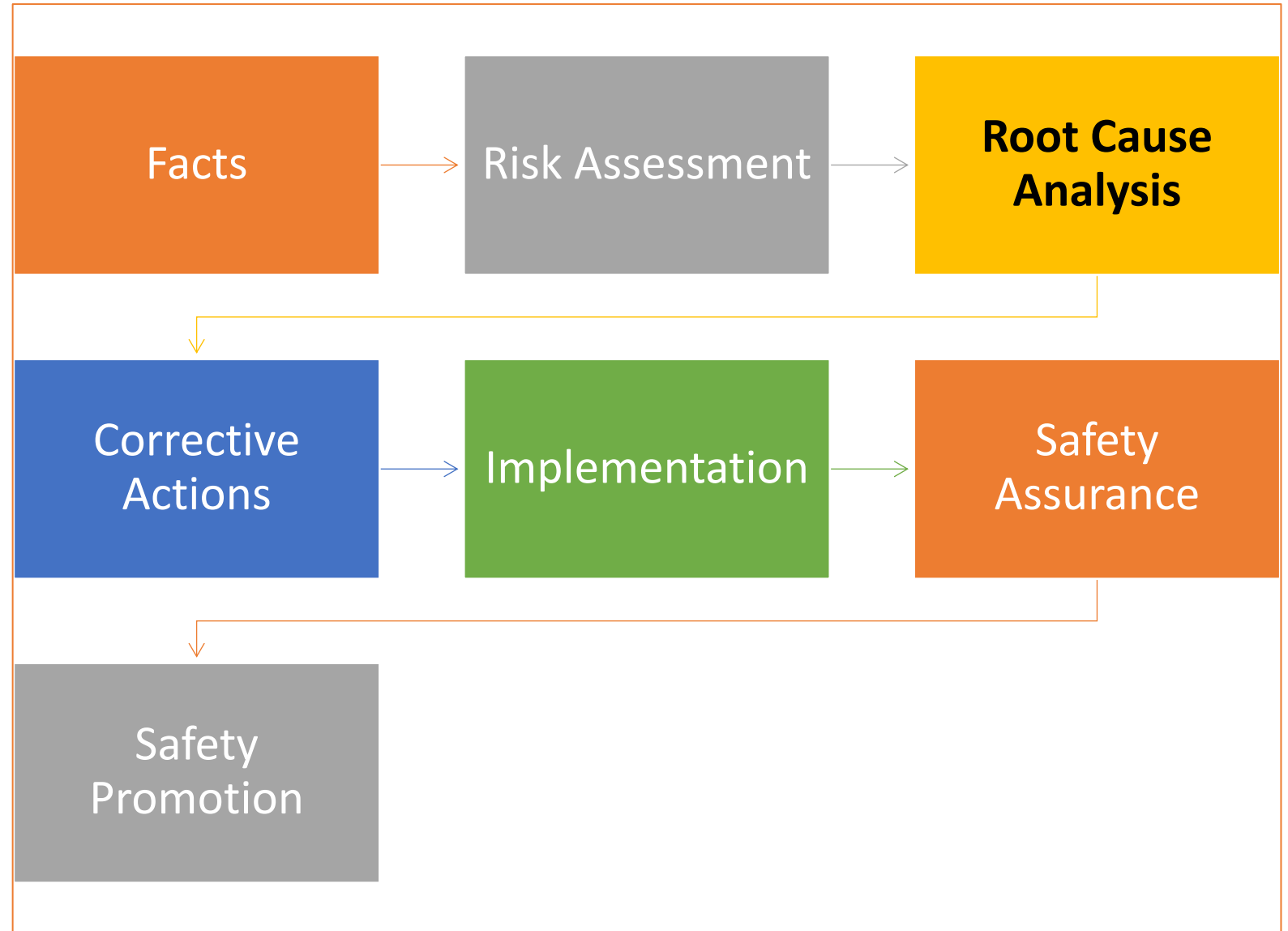
Definitions	Risk Severity				
	5 Catastrophic	4 Critical	3 Significant	2 Marginal	1 Negligible
Effect on Employee	Multiple fatality	Single fatality	Serious injury	Minor injury	Slight/ No injury
Effect on Environment	Massive effect	Major effect	Localized effect	Minor effect	Slight/ No effect
Effect on Mission	Total mission failure	Multiple significant mission element failures	Single significant mission element failures	Certain mission failure elements	Minor degradation

Risk Index

BEFORE AND AFTER THE CORRECTIVE ACTIONS

WHY?

Structure of Safety Investigation



Safety Investigation - Analysis

Based on Facts /
Supported by Evidence

Avoid Assumptions

Need to find main and
contributing factors



WHY DID THIS HAPPEN?

This is **THE MAGIC** Question to reach
main and contributing factors

Safety Investigation - Analysis

Study of reports

Interviews of all involved

Study of applicable systems, components, controls

Visit/audit of required facilities

Re-interviews / Re-visits if required

Compilation of data

Finalization of root causes & contributory factors

Exercise 1

- **Scenario:**
 - Fuel spill on the apron area surface of approximately 25 m (75 ft) length and 5 m (15 ft) width, produced by an A310 ready to pushback and taxi for departure
- **Report by the apron responsible person:**
 - After the A310 pushback the spill was contained and the apron area was decontaminated

1. Identify the hazard(s)

2. Determine the hazard(s) consequence(s)

3. Assess the probability of the risk:



4. Assess the severity of the risk



5. Determine the resulting risk index



6. Establish the risk tolerability



Exercise 2

- **Scenario:**
 - It was observed that airline baggage handling personnel generates FO(D) on the aerodrome apron area
- **Report by the apron responsible person:**
 - It should be noted that airline baggage handling personnel are not complying with safety standards as set in the aerodrome operating manual. This is considered a hazard that can produce incident or accident in the movement area

1. Identify the hazard(s)

2. Determine the hazard(s) consequence(s)

3. Assess the probability of the risk:



4. Assess the severity of the risk



5. Determine the resulting risk index



6. Establish the risk tolerability



Exercise 3

- **Scenario:**

- A parked aircraft shows damage in the left wing root near the fuselage. Such damage was caused by a maintenance stair hitting the aircraft as a consequence of the wind, apparently because the stair was not properly restrained

- **Report by the apron responsible person:**

- In conditions of strong winds it is essential that all equipment around aircraft is properly restrained and locked, thus preventing the possibility of aircraft damage

1. Identify the hazard(s)

2. Determine the hazard(s) consequence(s)

3. Assess the probability of the risk:



4. Assess the severity of the risk



5. Determine the resulting risk index



6. Establish the risk tolerability



Exercise 4

- **Scenario:**
 - The vehicle and ramp equipment parking area behind the fingers shows a large amount of FO(D) (food, trays, plastics, pillows, etc.) left behind by an airline
- **Report by the apron responsible person:**
 - The presence of decomposed food and others dangerous material was informed to the airline, since in addition to FO(D), this presents a bacteriological danger for people who operate in this sector, also attracting animals to the operative apron

1. Identify the hazard(s)

2. Determine the hazard(s) consequence(s)

3. Assess the probability of the risk:



4. Assess the severity of the risk



5. Determine the resulting risk index



6. Establish the risk tolerability



Exercise 5

- **Scenario:**
 - A loose wheel, apparently from a baggage cart, was observed in the handling area. The driver apparently did not notice what happened. The wheel rolled at high speed through the area, hitting the fence accessing the fuel zone
- **Report by the apron responsible person:**
 - This could have caused injuries to ramp personnel in addition to material damage to equipment and/or aerodrome facilities. We have insisted in the past on the periodic verification of all equipment and vehicles that operate in the aerodrome apron area

1. Identify the hazard(s)

2. Determine the hazard(s) consequence(s)

3. Assess the probability of the risk:



4. Assess the severity of the risk



5. Determine the resulting risk index



6. Establish the risk tolerability



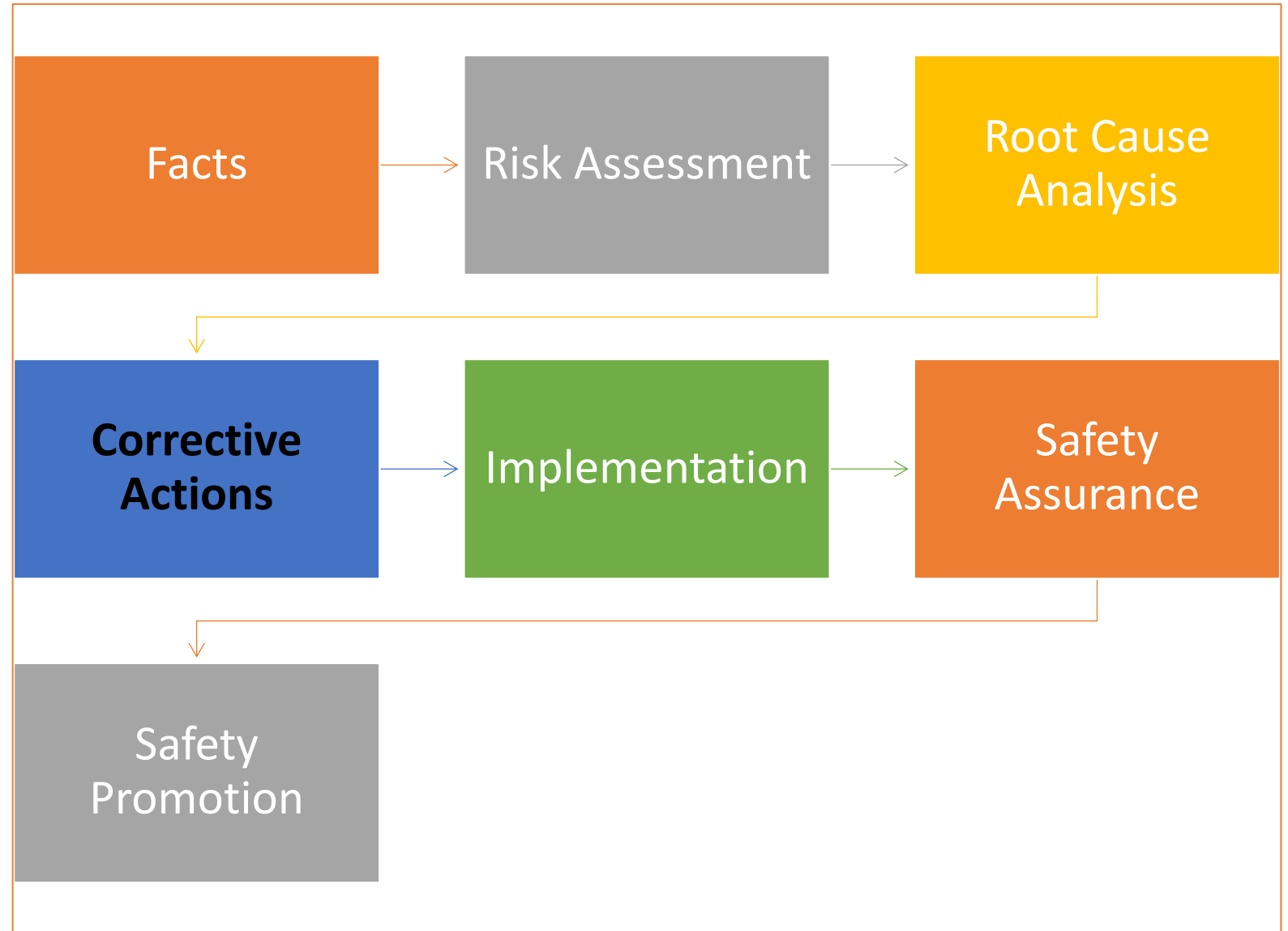
Exercise 6

- **Scenario:**
 - The absence of airline personnel attending the stairs was observed in three occasions, in flights from different companies. The presence of airline personnel is necessary to guide passengers when embarking and disembarking
- **Report by the apron responsible person:**
 - This is a risk for passengers, since they should access the apron to board aircraft in an orderly manner under the guidance of airline personnel

Warm-up exercise N°05/06 – results

1. Identify the hazard(s) _____ _____ _____ _____ _____	3. Assess the probability of the risk:		
	4. Assess the severity of the risk		
2. Determine the hazard(s) consequence(s) _____ _____ _____ _____ _____	5. Determine the resulting risk index		
	6. Establish the risk tolerability		

Structure of Safety Investigation



Safety Investigation

Corrective Actions



To be addressed to ROOT CAUSES



Review of applicable existing controls



Design of new corrective actions/procedures



Anticipated outcomes

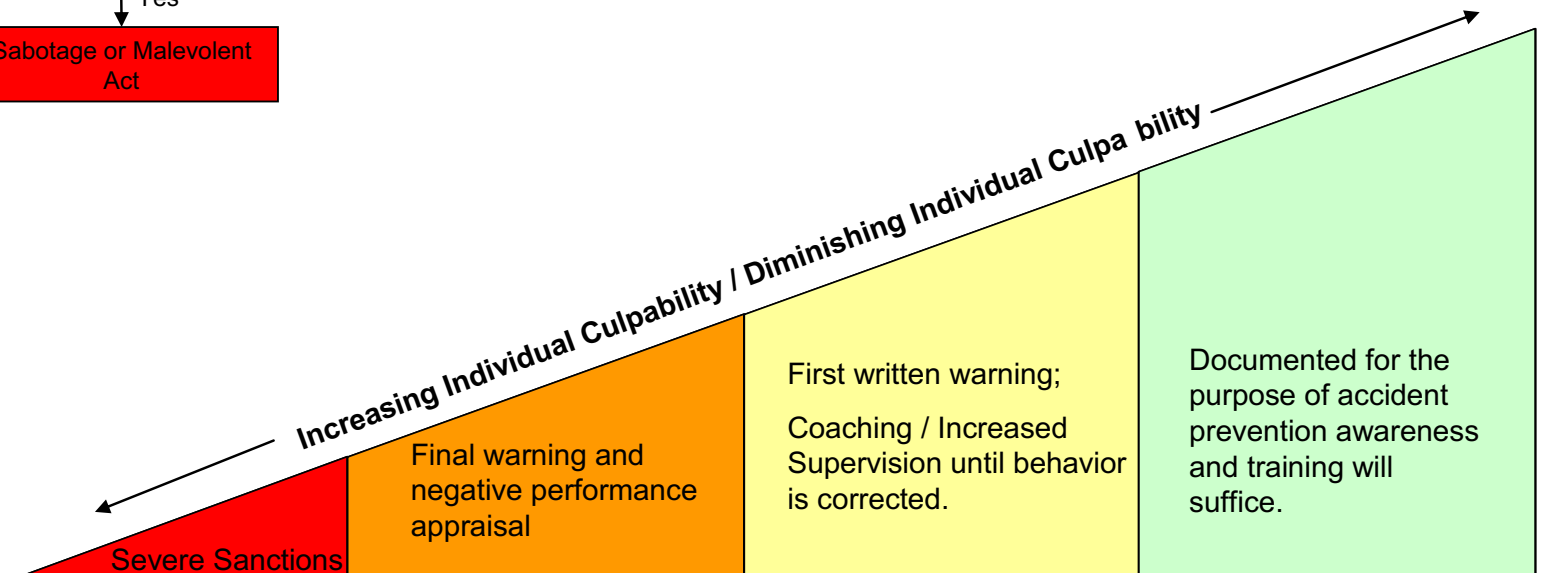
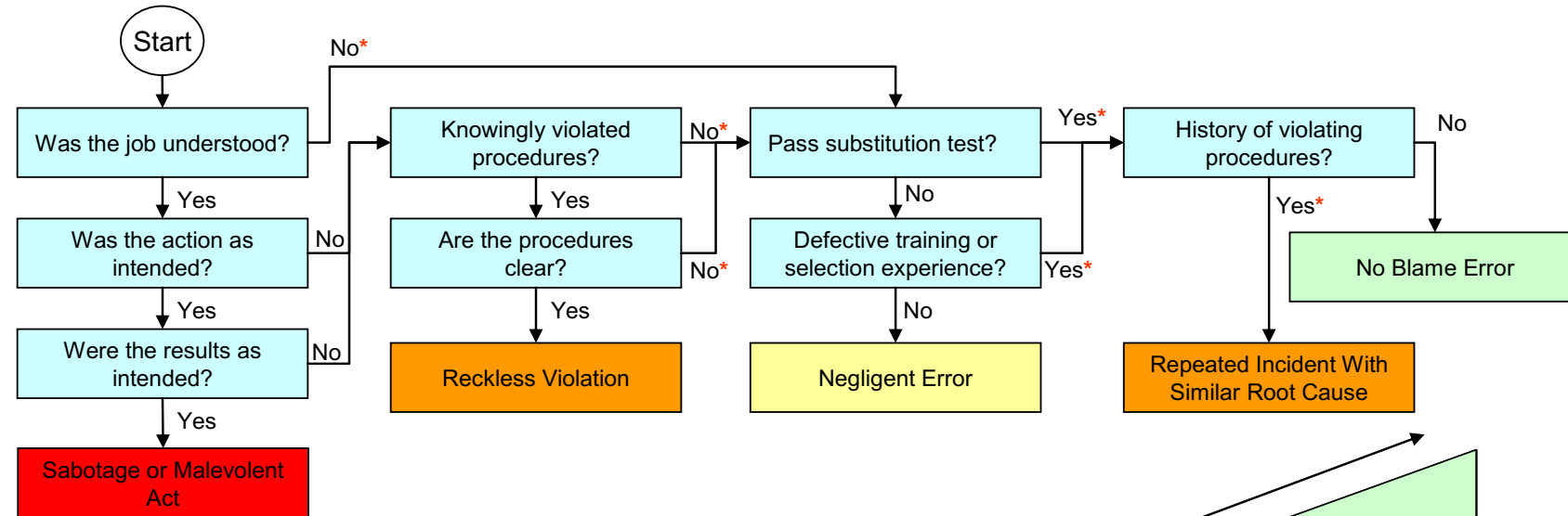


Evaluation of impact of new corrective actions on existing controls/regulations



Just Culture Application - If required

Just Culture



* Indicates a 'System' induced error. Manager/supervisor must evaluate what part of the system failed and what corrective and preventative action is required. Corrective and preventative action shall be documented for management review.

Structure of Safety Investigation



Safety
Investigation

Implementation of
Corrective Actions



Safety
Investigation

Implementation of
Corrective Actions

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Structure of Safety Investigation

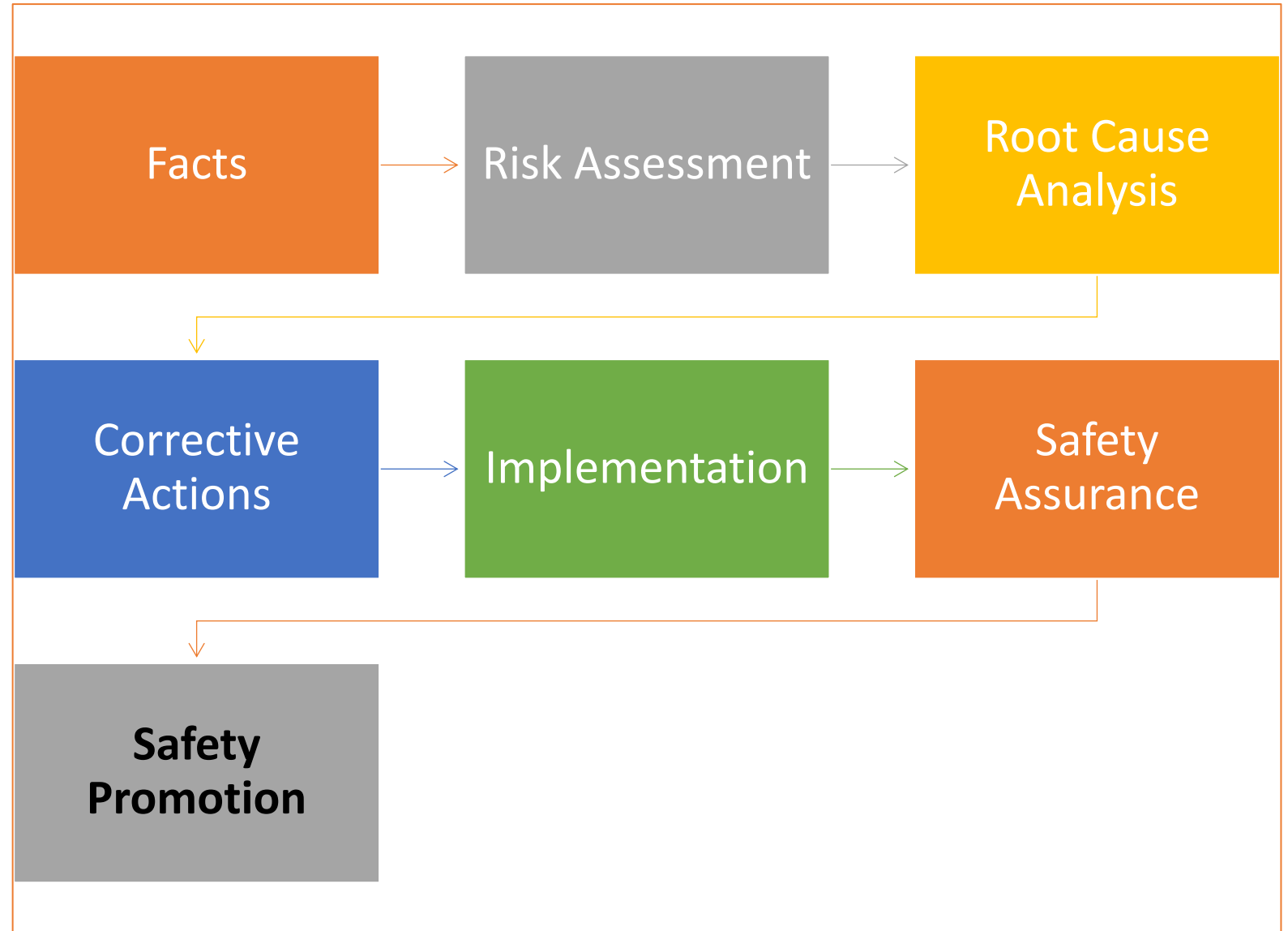


Safety
Investigation

Safety
Assurance

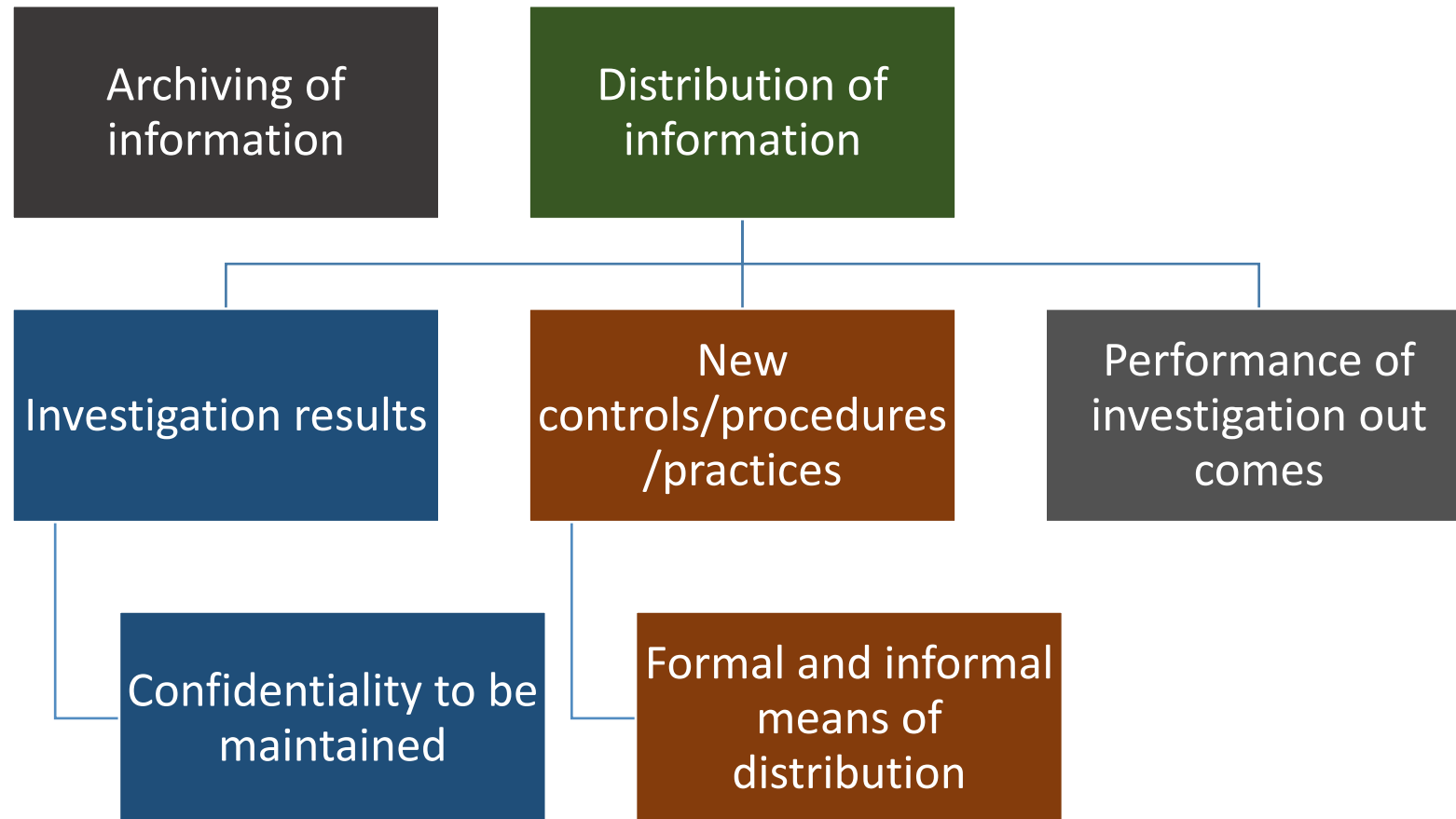
- Performance review of implemented corrective actions / controls
- Addition to audits
- Surveys
- Review of incident/hazard reports for gauging the impact
- Feedback from control groups
- Safety Performance Measurement review
- Performance in external audits

Structure of Safety Investigation



Safety Investigation

Safety Promotion



Safety Investigation

When its Closed ?



Safety Investigation - Closing

- After the corrective actions are finalized
 - Complete internal report
 - Sign off by Competent Authority
 - Distribution to internal and external stake holders
 - Submission to NCAA
- 
- A large yellow triangle is positioned in the bottom right corner of the slide, pointing towards the top right.



Conclusion





Questions



*Thank
you*

